USDA Natural Resources
Conservation Service

Ecological site R046XC519MT
Limy Droughty (LyDr) RRU 46-C 13-19 PZ

Last updated: 7/19/2023
Accessed: 05/06/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

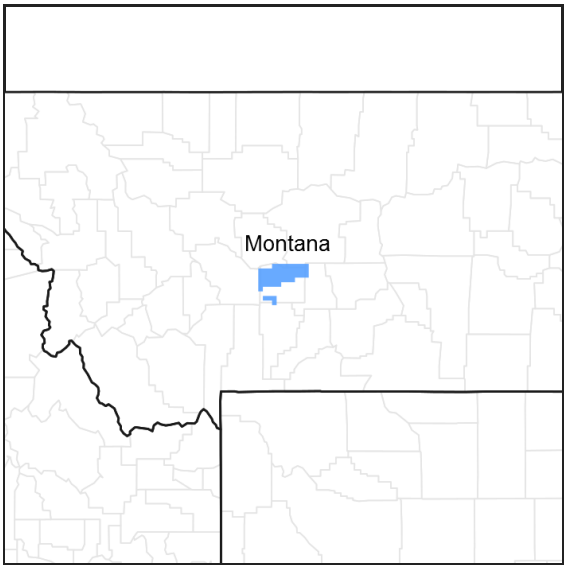


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Associated sites

R046XC505MT	**Sandy (Sy) RRU 46-C 13-19 PZ**
R046XC506MT	**Shallow (Sw) RRU 46-C 13-19 PZ**
R046XC508MT	**Silty (Si) RRU 46-C 13-19 PZ**
R046XC510MT	**Limy (Ly) RRU 46-C 13-19 PZ**

Similar sites

R046XC508MT	**Silty (Si) RRU 46-C 13-19 PZ** The Silty site differs mainly by also having few rocks, plus significantly less lime, particularly at the surface.
R046XC510MT	**Limy (Ly) RRU 46-C 13-19 PZ** The Silty-Limy site differs mainly by having few rocks, giving it a better soil water relationship and better plant cover.
R046XC506MT	**Shallow (Sw) RRU 46-C 13-19 PZ** The Shallow site differs by having bedrock within 20 inches of the surface.

R046XC507MT	**Shallow to Gravel (SwGr) RRU 46-C 13-19 PZ** The Shallow to Gravel site differs by having gravels within 20 inches of the surface, and being less limy at the surface.
R046XC505MT	**Sandy (Sy) RRU 46-C 13-19 PZ** The Sandy site differs mainly by also having few rocks, plus significantly less lime, particularly at the surface.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Hesperostipa comata*

Physiographic features

This ecological site occurs on nearly level to strongly sloping valleys, terraces, and fans. The slopes range from 0 – 15%, but are mainly less than 8%. Occasionally, this site will occur on slopes steeper than 15%. This site occurs on all exposures. Aspect is not significant.

Table 2. Representative physiographic features

Landforms	(1) Valley (2) Fan (3) Terrace
Flooding frequency	None to rare
Ponding frequency	None
Slope	0–15%
Water table depth	102 cm
Aspect	Aspect is not a significant factor

Climatic features

See Climatic Data Sheet for more details (Section II of the Field Office Technical Guide) or reference the following climatic web site: http://www.wrcc.sage.dri.edu/ .

Table 3. Representative climatic features

Frost-free period (characteristic range)	67-87 days
Freeze-free period (characteristic range)	111-124 days
Precipitation total (characteristic range)	381-432 mm
Frost-free period (actual range)	53-88 days
Freeze-free period (actual range)	104-126 days
Precipitation total (actual range)	356-483 mm
Frost-free period (average)	76 days
Freeze-free period (average)	116 days
Precipitation total (average)	432 mm

Climate stations used

- (1) RAYNESFORD 2 NNW [USC00246902], Raynesford, MT

- (2) STANFORD [USC00247864], Stanford, MT
- (3) LEWISTOWN MUNI AP [USW00024036], Lewistown, MT
- (4) ZORTMAN [USC00249900], Zortman, MT
- (5) DENTON [USC00242347], Denton, MT
- (6) HOBSON [USC00244193], Hobson, MT

Influencing water features

No influencing water features.

Soil features

These soils are very gravelly and very cobbly loams more than 20 inches deep that have loamy surfaces and are strongly to violently effervescent within 4 inches of the surface. They typically have a calcic horizon within 12 inches of the surface. The soils are formed in alluvium, colluvium, or residuum. Texture will vary between loam, silt loam, sandy loams, sandy clay loams, and clay loam. The amount of rock present reduces the available water holding capacity to less than 5 inches.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Sandy loam (3) Sandy loam
Drainage class	Moderately well drained to well drained
Permeability class	Moderate
Soil depth	51 cm
Available water capacity (0-101.6cm)	0–12.7 cm
Calcium carbonate equivalent (0-101.6cm)	15%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	10–20%
Subsurface fragment volume >3" (Depth not specified)	10–50%

Ecological dynamics

This site developed under Northern Rocky Mountain foothills climatic conditions, which included the natural influence of large herbivores and occasional fire. The plant community upon which interpretations are primarily based is the Historic Climax Plant Community (HCPC). This community is described as a reference to understand the original potential of this site, and is not always considered to be the management goal for every acre of rangeland. The following descriptions should enable the landowner or manager to better understand which plant communities occupy their land, and assist with setting goals for vegetation management. It can also be useful to understand the environmental and economic values of each plant community.

This site is considered only slightly resilient to disturbance as it has significant soil limitations (amount of lime and rock content) for plant growth. Changes may occur to the Historic Climax Plant Community due to management actions and/or climatic conditions. Under continued adverse impacts, a moderate to extreme decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments this site can more readily return to the Historic Climax Plant Community (HCPC).

Continual adverse impacts to the site over a period of years results in a departure from the HCPC, with a decrease

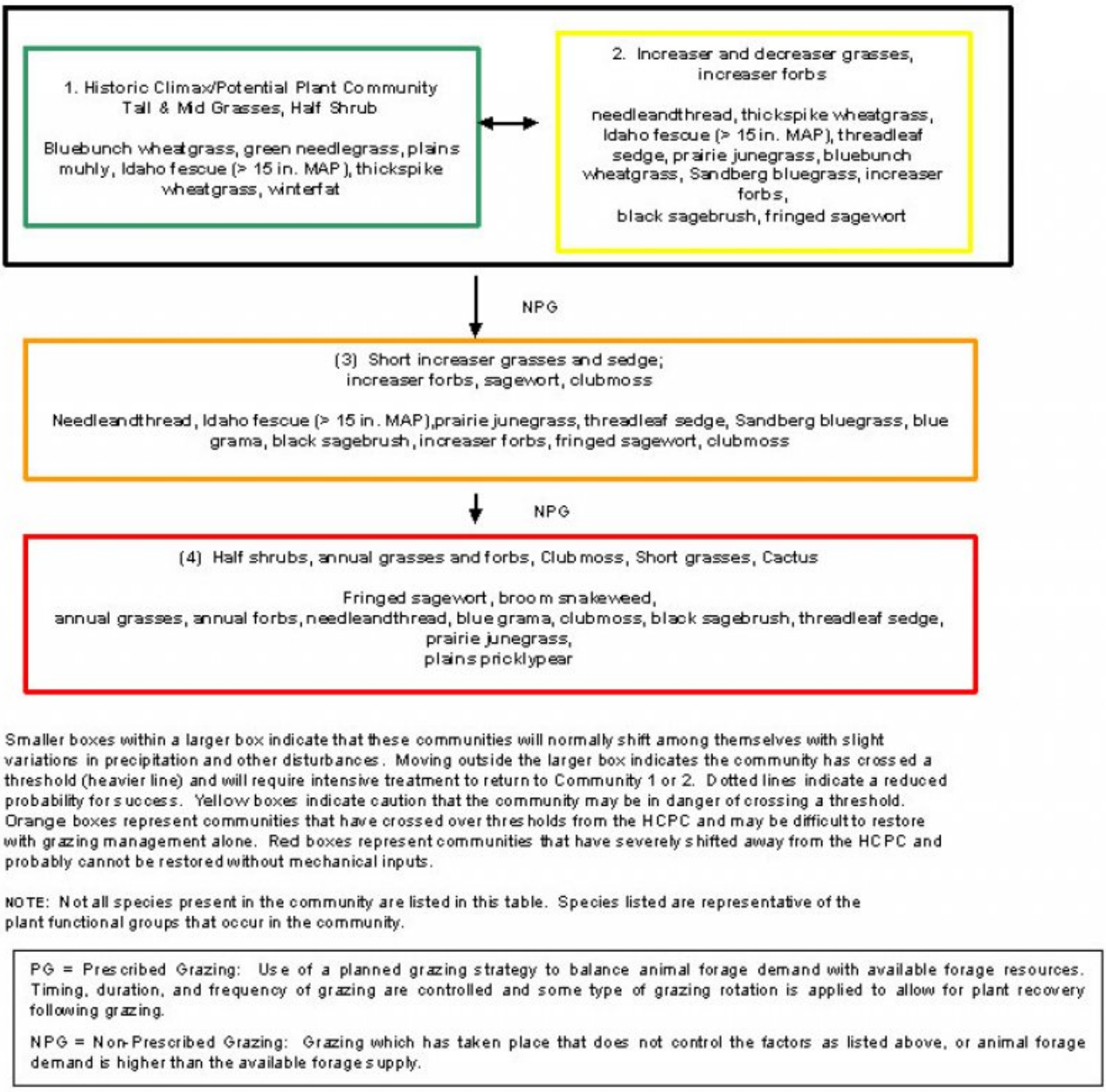
of the taller, more palatable species such as bluebunch wheatgrass and green needlegrass. These plants will typically be replaced by a mixture of medium and short grasses and sedges, including Idaho fescue (mainly 15 inches MAP or more), thickspike wheatgrass, needleandthread (mainly less than 15 inches MAP), Sandberg bluegrass, prairie junegrass, spike oatgrass, and plains reedgrass. Several species of less desirable and non-palatable forbs such as hairy goldenaster, pussytoes, and asters and daisys will be common. Fringed sagewort also becomes abundant.

Continued deterioration to the community results in short grasses (Sandberg bluegrass, prairie junegrass, spike oatgrass, plains reedgrass) becoming dominant. Undesirable species such as red threeawn, broom snakeweed, and plains pricklypear cactus will become abundant.

Plants that are not a part of the Historic Climax Plant Community that are most likely to invade are annual grasses (cheatgrass, Japanese brome), and annual and biennial forbs. Leafy spurge, knapweeds, dalmation toadflax, and sulphur cinquefoil are potential noxious weed invaders on this site.

Long-term non-use (e.g., >3 years) combined with the absence of fire will result in excessive litter and decadent plants in the bunchgrass communities at higher precipitation zones.

State and transition model



Smaller boxes within a larger box indicate that these communities will normally shift among themselves with slight variations in precipitation and other disturbances. Moving outside the larger box indicates the community has crossed a threshold (heavier line) and will require intensive treatment to return to Community 1 or 2. Dotted lines indicate a reduced probability for success. Yellow boxes indicate caution that the community may be in danger of crossing a threshold. Orange boxes represent communities that have crossed over thresholds from the HCPC and may be difficult to restore with grazing management alone. Red boxes represent communities that have severely shifted away from the HCPC and probably cannot be restored without mechanical inputs.

NOTE: Not all species present in the community are listed in this table. Species listed are representative of the plant functional groups that occur in the community.

PG = Prescribed Grazing: Use of a planned grazing strategy to balance animal forage demand with available forage resources. Timing, duration, and frequency of grazing are controlled and some type of grazing rotation is applied to allow for plant recovery following grazing.

NPG = Non-Prescribed Grazing: Grazing which has taken place that does not control the factors as listed above, or animal forage demand is higher than the available forage supply.

Figure 8. State and Transition Model

State 1
Tall & Mid Grasses, Half Shrub

Community 1.1
Tall & Mid Grasses, Half Shrub

This is the interpretive plant community and is considered to be the Historic Climax Plant Community (HCPC) for this site. This plant community contains a moderate diversity of tall and medium height, cool and warm season grasses (bluebunch wheatgrass, green needlegrass, thickspike wheatgrass, plains muhly), and short grasses and sedges (Sandberg or Cusick bluegrass, Idaho fescue (mainly above 15 inch MAP), plains reedgrass, prairie junegrass, threadleaf sedge). There are abundant forbs (dotted gayfeather) which occur in smaller percentages. Sub-shrubs (winterfat) and shrubs (black sagebrush) can be common in some locations. This plant community is well adapted to the Northern Rocky Mountain foothills climatic conditions. The diversity in plant species allows for

drought tolerance. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation, and temperature). This plant community is well suited to managed livestock grazing and provides diverse habitat for many wildlife species. Plants on this site have strong, healthy root systems that allow production to increase significantly with favorable moisture conditions. This plant community provides for soil stability and a properly functioning hydrologic cycle. Plant litter is available for soil building and moisture retention. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. The soils associated with this site provide a limited soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	734	925	1110
Forb	45	117	207
Shrub/Vine	–	29	69
Total	**779**	**1071**	**1386**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-10%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-5%
Non-vascular plants	0-1%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	9-13%
Forb basal cover	1-2%
Non-vascular plants	0-1%
Biological crusts	0%
Litter	50-60%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	5-10%
Bedrock	0%
Water	0%
Bare ground	15-25%

State 2

Medium and Short Grasses, Sedge, Increaser Forbs

Community 2.1
Medium and Short Grasses, Sedge, Increaser Forbs

Early stages of degradation, including non-prescribed grazing, will tend to change the HCPC to a community dominated by medium and short grasses and sedges such as needleandthread, thickspike wheatgrass, Idaho fescue (mainly above 15 inch MAP), threadleaf sedge, prairie junegrass, and Sandberg bluegrass. A near monoculture of needleandthread can occur on some sites. The taller and more palatable plants (bluebunch wheatgrass, green needlegrass) can still be present but in smaller amounts. There may be an increase in the amount of shrubs, such as black sagebrush. Palatable and nutritious forbs will be replaced by less desirable and more aggressive species such as pussytoes and hairy goldenaster. Biomass production and litter become reduced on the site with as the taller grasses become replaced by shorter ones, especially the non-native grasses. Evapotranspiration tends to increase, moisture retention is reduced, and soil surface temperatures increase. Some natural ecological processes will be altered. These plant communities provide for moderate soil stability. Increased amounts of bare ground can result in undesirable species invading. Common invaders can include spotted knapweed, dalmation toadflax, sulphur cinquefoil, and leafy spurge. This plant community will readily respond to improved grazing management, but a significant amount of time can be necessary to move it toward a higher successional stage and a more productive plant community similar to community 1. The chances of returning to a community similar to number 1 with grazing management alone are somewhat reduced because of the concentration of lime (Calcium carbonate) at the surface and the rock content of the soil. This ecological site is generally unsuitable for re-seeding because of the rock content. Additionally, high lime soils are very susceptible to soil blowing.

State 3
Short and Mid Increaser Grasses and Sedge, Fringed Sagewort, Increaser Forbs, Cactus

Community 3.1
Short and Mid Increaser Grasses and Sedge, Fringed Sagewort, Increaser Forbs, Cactus

If the heavy disturbance, including non prescribed grazing, continues the site will become dominated by short and medium increaser grasses such as Sandberg bluegrass, blue grama, plains reedgrass, prairie junegrass, thickspike wheatgrass, and Idaho fescue, fringed sagewort, and increaser forbs such as pussytoes and western yarrow. There may still be remnant amounts of some of the late-seral species such as bluebunch wheatgrass and green needlegrass present The taller grasses will occur only occasionally. Palatable forbs will be mostly absent. Undesirable species such as red threeawn, plains pricklypear cactus and broom snakeweed can become common. Annuals and weedy species may begin to be apparent. This plant community is the result of long-term, heavy, continuous grazing and/or annual, early spring seasonal grazing. Repeated spring grazing depletes stored carbohydrates, resulting in weakening and eventual death of the cool season tall and medium grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. This community will respond positively to improved grazing management, but significant economic inputs and a signinicant amount of time are usually required to move this plant community toward a higher successional stage and a more productive plant community. The probability for returning this community to one resembling 1 using grazing management alone is low.

State 4
Half Shrubs, Annuals and Weedy Species, Short Grasses, Cactus

Community 4.1
Half Shrubs, Annuals and Weedy Species, Short Grasses, Cactus

Further deterioration of community 3 results in a plant community dominated by undesirable plants such as broom snakeweed, plains pricklypear cactus, fringed sagewort, weedy forbs (e.g., pussytoes and thistles), annuals and biennials such as cheatgrass and Japanese bromes and curlycup gumweed, and red threeawn. Needleandthread can sometimes remain a major component. Many other increaser sedges and short grasses such as threadleaf sedge, blue grama, prairie junegrass, Sandberg bluegrass and plains reedgrass will be abundant. Most of the climax species such as bluebunch wheatgrass will be gone. Black sagebrush will become abundant. Plant

communities 3 and 4 produce less usable forage for wildlife and livestock than the others described. The continuation of the downward trend and degradation of this site has resulted in higher soil surface temperatures, reduced water infiltration, and higher evapotranspiration. This has resulted in plant species that are more adapted to drier conditions, including blue grama and cactus. Most of the attributes of a healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling and energy flow, have been lost. Community 4 can respond positively to improved grazing management but it will take additional inputs to move them towards communities similar in production and composition to others that have been described. Because of the high lime content at or near the surface and the rock content, practices such as mechanical treatment or seeding are not recommended.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Shrubs and Half-shrubs**			0–69	
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–41	–
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	0–24	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–24	–
	black sagebrush	ARNO4	*Artemisia nova*	0–24	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–
Grass/Grasslike					
0	**Grasses and Sedges**			734–1110	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	415–902	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	90–207	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–140	–
	Idaho fescue	FEID	*Festuca idahoensis*	0–140	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–69	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–69	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–69	–
	green needlegrass	NAVI4	*Nassella viridula*	0–69	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–69	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–69	–
	Grass, perennial	2GP	*Grass, perennial*	0–69	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–69	–
	threadleaf sedge	CAFI	*Carex filifolia*	8–69	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–69	–
	poverty oatgrass	DASP2	*Danthonia spicata*	0–69	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–1	–
Forb					
0	**Forbs**			45–207	
	woolly groundsel	PACA15	*Packera cana*	0–69	–
	spiny phlox	PHHO	*Phlox hoodii*	0–69	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–69	–
	Forb, perennial	2FP	*Forb, perennial*	0–69	–
	pussytoes	ANTEN	*Antennaria*	0–69	–
	fleabane	ERIGE2	*Erigeron*	0–69	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–69	–
	rubberweed	HYMEN7	*Hymenoxys*	0–69	–
	dotted blazing star	LIPU	*Liatris punctata*	1–69	–
	desertparsley	LOMAT	*Lomatium*	0–69	–
	locoweed	OXYTR	*Oxytropis*	0–1	–

Animal community

Livestock Grazing Interpretations:
Managed livestock grazing is suitable on this site as it has the potential to produce a moderate amount of high quality forage. Grazing must be managed carefully on this site to be sure livestock drift onto the better, more productive sites is not excessive. Management objectives should include maintenance or improvement of the native plant community.

Using shorter grazing periods and providing for adequate re-growth after grazing are recommended for plant maintenance, health, and recovery. Continual non prescribed grazing of this site can be detrimental and will alter the plant composition and production over time. The result will be plant communities that resemble numbers 3 and 4, depending on how long this grazing management is used as well as other circumstances such as weather conditions and fire frequency.

Whenever Plant Community 2 (medium and short grasses) occurs, grazing management strategies that will prevent further degradation need to be implemented. This community is still stable, productive, and healthy provided it receives proper management. It will respond fairly quickly to improved grazing management, including increased growing season rest of key forage plants. Grazing management alone can usually move this back towards the potential / historic climax community. However, the probability for success is significantly reduced because of the limy, very rocky soils.

Plant community 3 is the result of long-term, heavy, continuous grazing and/or annual, early spring seasonal grazing. Repeated heavy early spring grazing, especially during stem elongation (generally mid May through mid June), can also have detrimental affects on the taller, key forage species. Repeated spring grazing depletes stored carbohydrates, resulting in weakening and eventual death of the cool season tall and medium grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur.

The management objective at this point needs to be to implement a grazing strategy that will restore the stability and health of the site and prevent further degradation to Plant Community 4. Rest, usually for a number of years, can sometimes help with re-establishment of the desired species, depending on the amount of desirable species remaining.

Plant Community 4 has a high percentage of aggressive, less-desirable species. It has lost most of the attributes of a healthy rangeland. Grazing management alone is seldom able to restore the site to one that resembles the HCPC once this plant community has become established. There are major limitations to using seeding and/or mechanical treatment on this site due to the limy (calcareous), very rocky soils.

Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. Safe stocking rates will be based on useable forage production, and should consider ecological condition and trend of the site, and past grazing use history.

Calculations used to determine a safe stocking rate are based on the amount of useable forage available, taking into account the harvest efficiency of the animal and the grazing strategy to be implemented. Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

The following is an example of how to calculate the recommended stocking rate. This example does not use production estimates from this specific ecological site. You will need to adjust the annual production values and run the calculations using total annual production values from the ecological sites encountered on each individual ranch/pasture. Before making specific recommendations, an on-site evaluation must be made.

Example of total annual production amounts by type of year:
Favorable years = 2200 lbs/acre
Normal years = 1480 lbs/acre
Unfavorable years = 1200 lbs/acre

It is recommended that on slopes of 30% or less, stocking rate should be derived from the total annual production

pounds minus 500 pounds for residual dry matter and 25% harvest efficiency. On slopes over 30%, stocking rate is derived from total annual production pounds minus 800 pounds for residual dry matter and 25% harvest efficiency. Refer to the NRCS National Range and Pasture Handbook for a list of Animal Unit Equivalents.

Sample Calculations using Favorable Year production amounts:

< 30% slopes: AUM/AC = [(2200-500)(0.25)]/915 lbs/month for one AU = 0.46 AUM/AC
AC/AUM = (1.0 AU)/(0.46AUM/AC) = 2.2 AC/AUM

> 30% slopes: AUM/AC = [(2200-800)(0.25)]/915 lbs/month for one AU = 0.38 AUM/AC
AC/AUM = (1.0 AU)/(0.38 AU! M/AC) = 2.6 AC/AUM

NOTE: 915 lbs/month for one Animal Unit is used as the baseline for maintenance requirements. This equates to 30 lbs/day of air-dry forage (1200 lb cow at 2.5% of body weight).

Hydrological functions

The runoff potential for this site is moderate, depending on slope and ground cover/health. Runoff curve numbers generally range from 66 to 84. The soils associated with this ecological site are generally in Hydrologic Soil Group B. Soils have a modertate infiltration rate when thoroughly wetted and consist chiefly of soils with moderately fine to moederately coarse textures.

Good hydrologic conditions exist on rangelands if plant cover (grass, litter, and brush canopy) is greater than 70%. Fair conditions exist when cover is between 30 and 70%, and poor conditions exist when cover is less than 30%. Sites in high similarity to HCPC (Plant Communities 1 and 2) generally have enough plant cover and litter to optimize infiltration, minimize runoff and erosion, and have a good hydrologic condition. The deep root systems of the potential vegetation help maintain or increase infiltration rates and reduce runoff.

Sites in low similarity (Plant Communities 3 and 4) are generally considered to be in poor hydrologic condition as the majority of plant cover is from shallow-rooted species such as blue grama and annual grasses. Erosion is minor for sites in high similarity. Rills and gullies should not be present. Water flow patterns, if present, will be barely observable. Plant pedestals are essentially non-existent. Plant litter remains in place and is not moved by erosion. Soil surfaces should not be compacted or crusted. Plant cover and litter helps retain soil moisture for use by the plants. Maintaining a healthy stand of perennial vegetation will optimize the amount of precipitation that is received. (Reference: Engineering Field Manual, Chapter 2 and Montana Supplement 4).

Recreational uses

Recreation and Natural Beauty: This site provides some limited recreational opportunities for hiking, horseback riding, big game and upland bird hunting. The droghty soils and rock content diminsh the quality of the experience. The forbs have flowers that appeal to photographers. This site provides valuable open space. Caution should be used during wet weather periods.

Wood products

None

Contributors

Matt Ricketts
Robert Leinard; Barbara Gibbons; Loretta Metz; Peter Husby Jon Siddoway, Matt Rickets

Approval

Kirt Walstad, 7/19/2023

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	G. Petersen K. Walstad
Contact for lead author	grant.petersen@usda.gov
Date	03/01/2020
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are not present in the reference condition.

2. **Presence of water flow patterns:** Water flow patterns are not present in the reference condition.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are not evident in the reference condition.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 10-15%. It consists of small, randomly scattered patches.

5. **Number of gullies and erosion associated with gullies:** Gullies are not present in the reference condition.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind scoured, or depositional areas are not evident in the reference condition.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is not evident in the reference condition.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** The average soil stability rating is 4-6 under plant canopies and plant interspaces. The A horizon is 3-6 inches thick.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil

Structure at the surface is weak coarse to fine granular. A Horizon should be 4-6 inches thick with color, when wet, typically ranging in Value of 4 or less and Chroma of 3 or less.
Local geology may affect color, it is important to reference the Official Series Description (OSD) for characteristic range. https://soilseries.sc.egov.usda.gov/osdname.aspx

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration of the Limy Droughty ecological site is high and is well drained. An even distribution of mid stature grasses (75-80%), cool season bunchgrasses (10-15%) along with rhizomatous grass (5%), forbs (5-15%), and shrubs (0-3%)

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** A compaction layer is not present in the reference condition. Soil profile may contain an abrupt transition to an Argillic horizon which can be misinterpreted as compaction, however, the soil structure will be fine to medium subangular blocky, where a compaction layer will be platy or structureless (massive).

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mid-statured, cool season, perennial bunchgrasses (Primarily bluebunch wheatgrass)

    Sub-dominant: shortgrass grasses/grasslikes (needle and thread, prairie Junegrass) ≥ forbs > rhizomatous grasses >> Shrubs

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Mortality in herbaceous species is not evident. Species with bunch growth forms may have some natural mortality in centers is 3% or less.

---

14. **Average percent litter cover (%) and depth (in):** Total litter cover ranges from 50-60%. Most litter is irregularly distributed on the soil surface and is not at a measurable depth.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average annual production is 955. Low: 695 High 1237. Production varies based on effective precipitation and natural variability of soil properties for this ecological site.

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state**

for the ecological site: Potential invasive (including noxious) species (native and non-native). Invasive species on this ecological site include (but not limited to) sulphur cinquefoil, yellow salsify, annual brome spp., spotted knapweed, yellow toadflax, leafy spurge, crested wheatgrass

Native species such as Rocky Mountain juniper, ponderosa pine, Douglas fir, broom snakeweed, Sandberg's bluegrass, etc. when their populations are significant enough to affect ecological function, indicate site condition departure.

---

17. **Perennial plant reproductive capability:** In the reference condition, all plants are vigorous enough for reproduction either by seed or rhizomes in order to balance natural mortality with species recruitment.
